ASPECTS OF SUCCESSION IN BIG MARSH. KENT COUNTY, MD
A MARSH/SWAMP FOREST ECOSYSTEM
IMPACTED BY PEAT MINING

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ASPECTS OF SUCCESSION IN BIG MARSH, KENT COUNTY, MARYLAND, A MARSH/SWAMP FOREST ECOSYSTEM IMPACTED BY PEAT MINING

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Introduction

In general the majority of Maryland's coastal wetlands are located in Dorchester and Somerset Counties on its lower eastern shore of Chesapeake Bay (McCormick and Somes 1982). These marshes are characterized by broad flat expansives of grasses dominated by Spartina, Scirpus, Juncus, or other genera. The size and species composition of these marshes is largely a function of the low topography, watershed hydrology, and salinity regimes of this region. In contrast to these southern shore counties, the marsh acreage of counties along Maryland's upper eastern shore is considerably less (McCormick and Somes 1982). These upper shore areas are bordered by rolling terrain with marsh areas often restricted to the low areas between bluffs. Although these smaller - upper bay marshes may contribute less organic matter to total Chesapeake Bay production than their southern counterparts, they are still important in providing critical habitat for different wildlife, bird, and plant species.

Considering the well documented value of marshes in their roles of nutrient cycling, storm water buffering, detritus production, and waterfowl habitat, destruction of marsh acreage is of great concern to coastal managers. Marsh losses have been attributed to a variety of natural causes including sea level rise and recent investigations initiated by Maryland's Coastal Zone Management Program have attempted to document cause and effect relationships (Pendleton and Stevenson 1982). Natural causes of marsh loss are sometimes beyond the scope of man's control, however human activities directly or indirectly impacting marshes can be controlled. These man-made impacts may range from dredge and fill activities to the alteration of watershed drainage characteristics.

In the past decade peat mining operations in a freshwater marsh/swamp forest ecosystem in northwestern Kent County, Maryland (Figure 1) were implicated in vegetation changes reported for the lower marsh. Big Marsh is contained in a relatively short watershed draining agricultural lands and borders Chesapeake Bay just south of Howell Point. In the late 1960's peat mining operations were conducted in the upper drainage basin of Big Marsh and created several trench-like ponds in the swamp forest (Figure 2). In August 1971 a long trench was excavated along the length of the marsh towards the Bay. Mining operations were halted after this activity following a court order. The long trench excavated in 1971 intersected a natural creek channel meandering through Big Marsh at several locations and altered drainage patterns.

Local residents reported changes in the plant species composition of the marsh in succeeding years and felt the dredged channel was responsible. In order to divert water back into the natural creek channel, two bulkheaded check dams were constructed at strategic creek intersections (Figure 3). However, after several growing seasons following dam construction up through 1978 residents still reported a shift in marsh conditions from a cattail marsh, *Typha angustifolia*, to a marsh thicket with alder, *Alnus serrulata*, black willow, *Salix nigra*, and other species appearing more frequently. In order to determine what role the peat mining operations had had in changing the cattail stands in Big Marsh, the Coastal Resources Division of Maryland's Department of Natural Resources in cooperation with the University of Maryland Horn Point Environmental Laboratory undertook an ecological study of the marsh.

The main objective of our study was to determine what plant species changes had occurred over time in Big Marsh and what role peat mining had played in producing these changes superimposed upon natural succession processes.

Figure 1. Location of Big Marsh along Chesapeake Bay

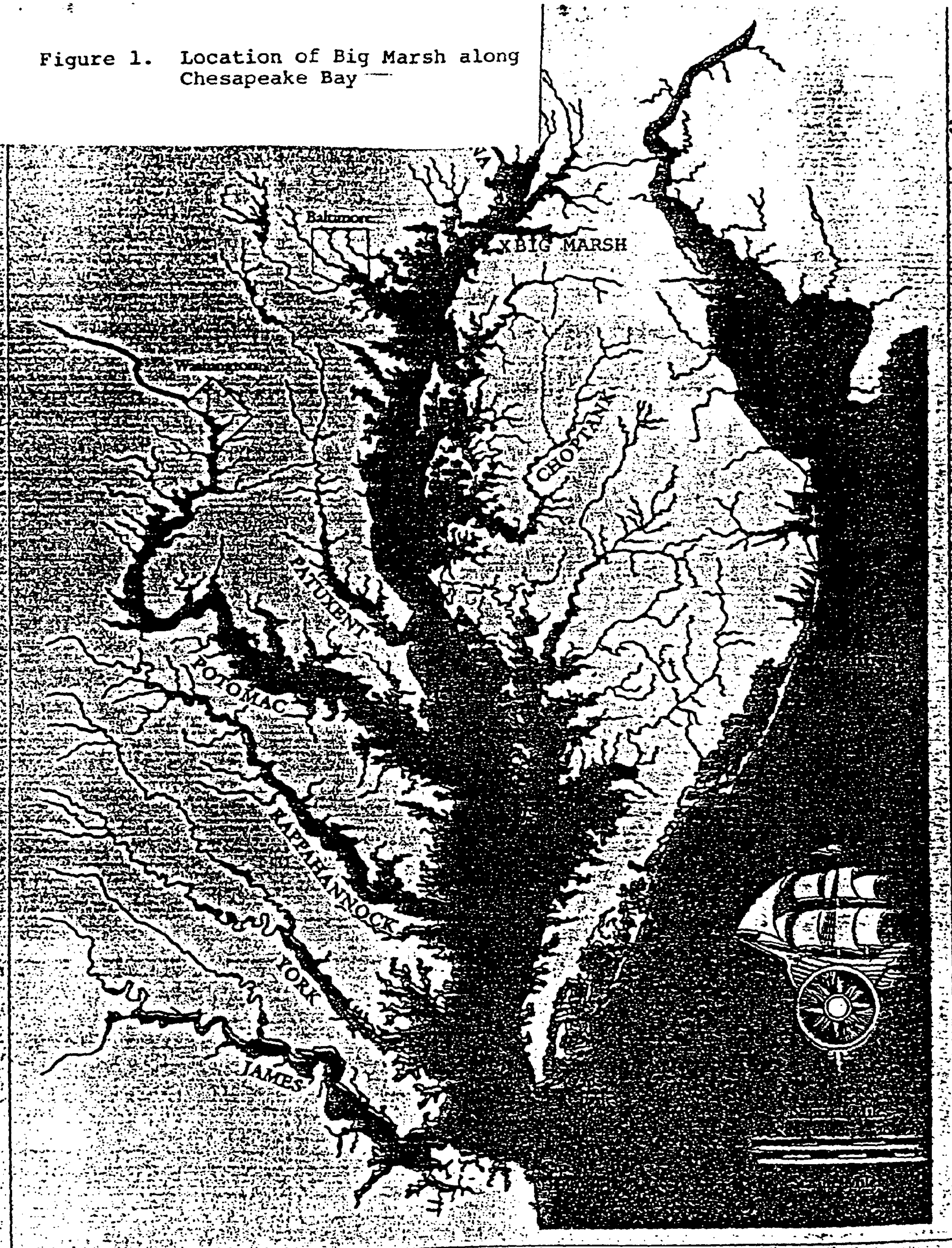

Figure 2. Trenches dredged by peat mining operations.

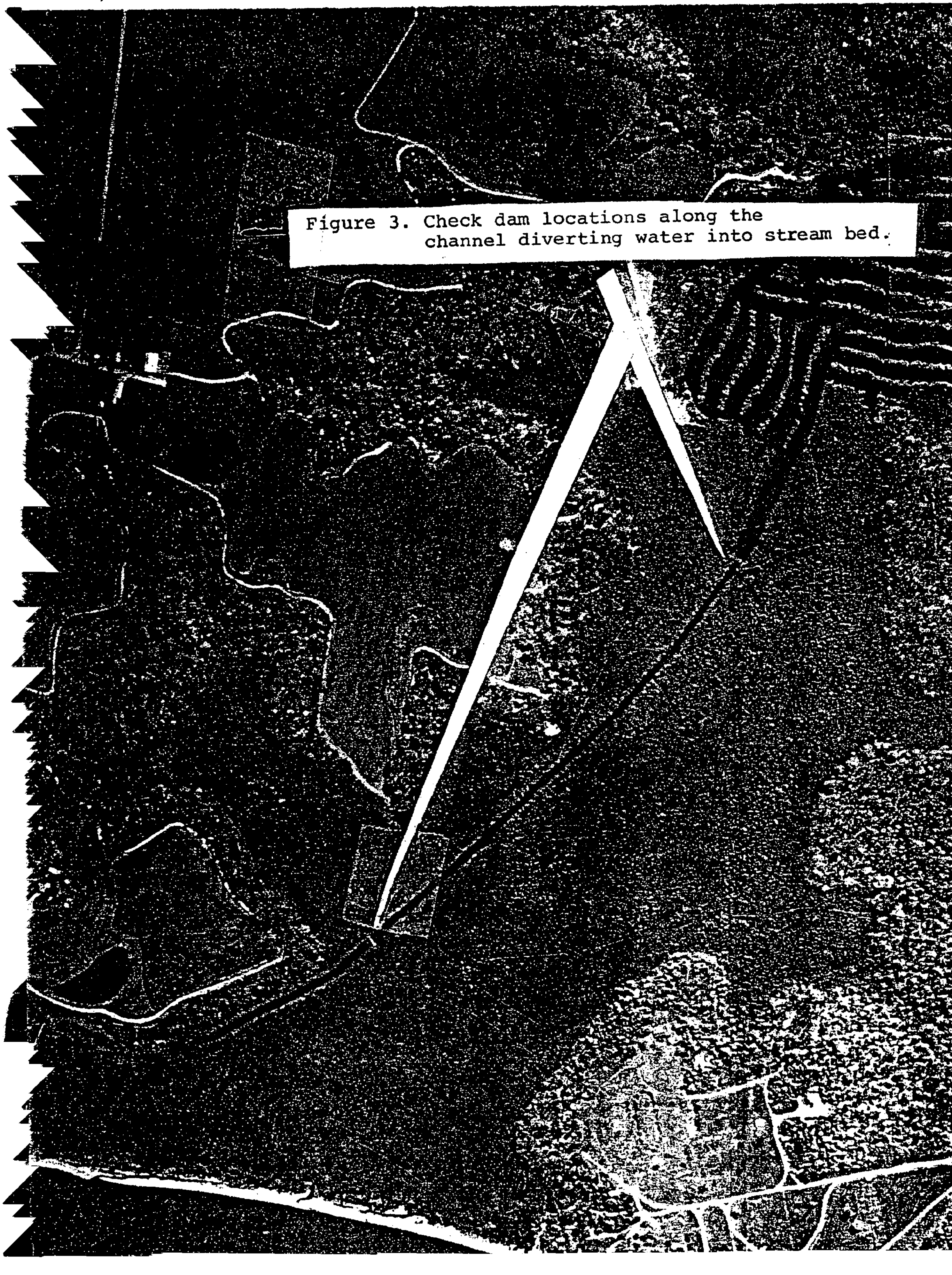

Figure 3. Check dam locations along the channel diverting water into stream bed.

The questions we were seeking to answer were: 1. How had the mining directly impacted the marsh? 2. Had natural ecological succession been occurring prior to peat mining? and 3. What role did mining play in the successional process relative to nature? We hypothesized that succession had been occurring in Big Marsh prior to the mining, but that the channels may have accelerated its rate.

Based upon our study results, we would develop management recommendations addressing what actions the State could take, if any, to preserve or restore Big Marsh.

Methods

In order to determine the general marsh species composition and plant distribution in the lower marsh area along its border with Chesapeake Bay, we established six randomized transects with stations randomly set at 64 yards along the transects. At each station measurements were made of water depth, species identification, and phytosociological (Wood 1970) associations among plants. Observations were also made of muskrat presence and other animal activity. These preliminary results were used to determine what additional studies should be developed.

We surveyed the direct impacts of the peat mining operations by entering the water-filled trenches by canoe and also traveling the length of the exit channel. Measurements were made of water depth, aquatic and terrestrial vegetation, and marsh drainage patterns (Figure 4).

Based upon the preliminary transects, we selected sites at different distances into the marsh to measure ages of woody vegetation to help determine succession rates. Samples were taken by coring device and chain saw. In addition to tree aging, succession rates were determined from aerial photographs of the marsh taken in 1936, 1957 and 1978. The 1978 photograph was ground-truthed by our field observations and used to compare the earlier photographs. Succession rates were determined by comparing the areal changes of the different plant zones (swamp forest, marsh thicket, marsh, and open water) from each year using a leaf area index instrument.

Figure 4. Vegetated banks of former mining areas.

Results and Conclusions

The general vegetation zones of Big Marsh included examples of some of the wetlands types described by McCormick and Somes (1982) including shrub swamp and fresh marsh. Large bog areas were also observed. Plant species diversity was generally high throughout the marsh except in pure cattail stands. Most of Big Marsh's nearly 2000 acres are composed of a shrub swamp dominated by red maple, Acer rubrum, and marsh thicket dominated by red maple, Acer rubrum, smooth alder, Alnus serrulata, posion ivy, Rhus radicans, and swamp rose, Rosa palustris.

Results from our preliminary transects of the western lower marsh area revealed that large areas of the marsh displayed transition stages of succession from marsh to shrub thicket. The northern most half of this marsh zone was still mainly pure cattail marsh (Figure 5), while the southern half displayed frequent distributions of alder, swamp rose, Hibiscus, poison ivy, and scattered red maples (Figure 6). T. angustifolia was still present throught much of the southern half except in dense stands of alder and poison ivy. In some parts of this southern successional area cattail stands exhibited typical freshwater marsh vegetation including arrowarum, Peltandra virginica and the royal fern, Osmunda regalis. Our initial transects were made early in the growing season, 1980, however fresh new shoots of T. angustifolia were seen emerging from the marsh surface (Figure 7).

We measured water depths throughout these successional marsh areas to determine whether marsh drainage was inhibiting cattail growth. All areas contained standing or flowing water, apparently sufficient for cattail growth, except in dense stands of alder and willow where dense root and sediment mats blocked cattail growth.

Figure 5. Pure cattail marsh in northern marsh area.

Figure 6. Southern area of marsh containing mixed marsh and shrub species.

Figure 7. New cattail growth among old shoots.

Of particular interest in this cattail marsh portion of Big Marsh were small groves of red maples observed growing in the middle of almost pure stands of T. angustifolia. We felt tree ages from these maple stands might be an indicator of how long ago succession had been occurring in this portion of the marsh. Samples from these trees and other species in the marsh indicated some of these trees had become established in the marsh as early as 1960, prior to peat mining. Once established, these pioneer trees, would have provided a seed source and helped trap sediment to make it easier for new trees to colonize the area (Figure 8).

In the area of Big Marsh actually mined for peat, primarily shrub marsh habitat, we found that the dredged ponds were now bordered with luxuriant aquatic plant growth and provided a very scenic view. Particularly notable were dense beds of water lilly, Nymphaea odorata, (Figure 9). We found that the bulkheaded dams were diverting water flow from the dredged channel into the natural stream bed. Water levels were higher on the upstream side of the dam (Figure 10) and flowed through a break in the channel's peat berm into the marsh stream. We also found evidence that during times of extreme rainfall water flow in the channel partially bypassed the stream entrance and passed over the dam. Nearly all plant growth was absent from the heavy peat berm crest, however cattails were observed growing on the lower outer slope of the berm (Figure 11).

Based upon our field measurements and aerial photography analyses, we determined that succession had been occurring in Big Marsh prior to the peat mining operations in the late 1960's and channel dredging in 1971. Tree ages in maple stands within the marsh predated mining operations and thus showed parts of lower Big Marsh were in a successional transitional stage from a cattail marsh to a shrub marsh. However, channel dredging may have speeded up the rate of succession in the early 1970's by altering marsh drainage patterns. If the water table were lowered enough in some of the marginal marsh areas, shrub species such as alders would have colonized areas more quickly than before; producing the

Figure 8. Island of maples growing withing cattail marsh.

Figure 9. Water lillies growing within former dredge channel.

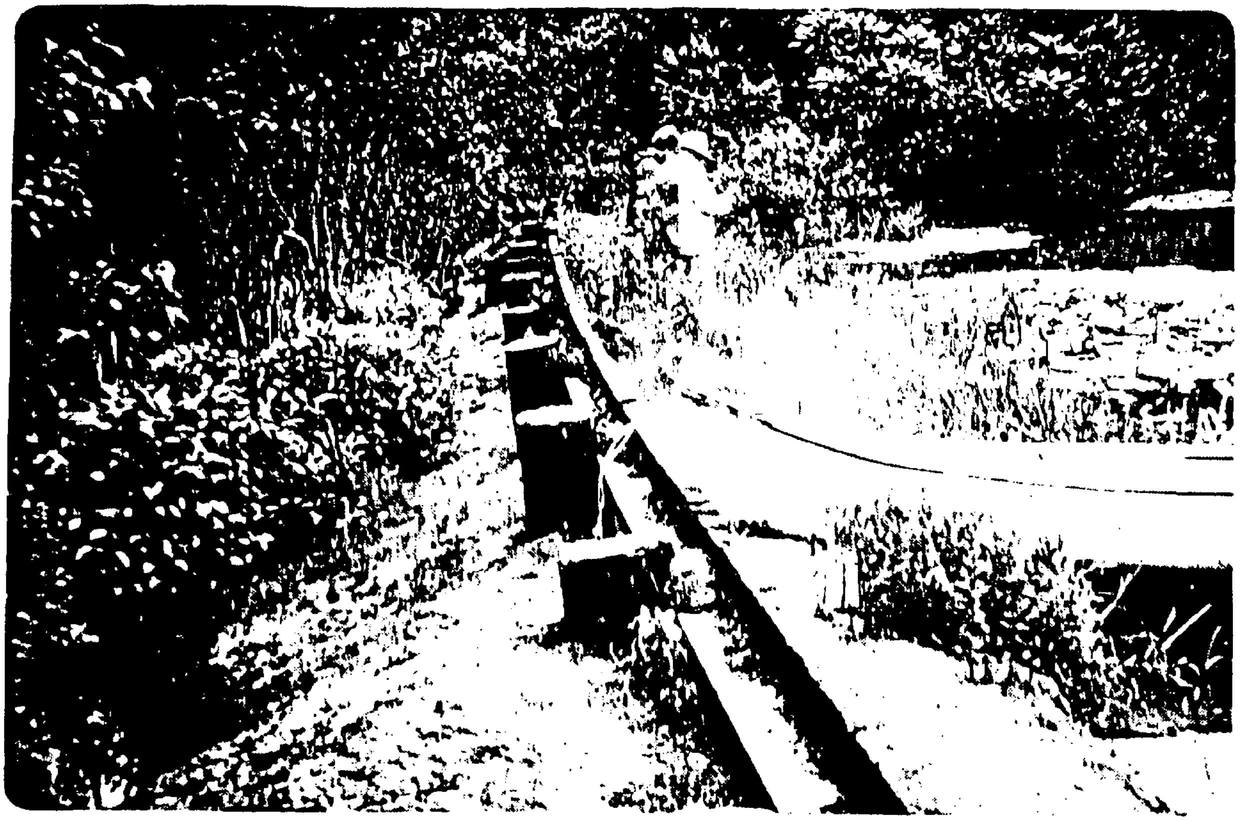

Figure 10. Check dam on dredge channel showing higher upstream water level.

Figure 11. Berm bordering channel. Note cattails growing along lower border in background.

vegetation changes observed by local residents. This observation is supported by the changes in marsh acreage between 1936 and 1978. Nearly 539 acres of marsh were present in 1936, while only 274 acres were present in 1978. We estimated that marsh loss through succession to shrub thicket had occurred at a rate of about 5.2 acres per year from 1936 to 1957, but had increased to nearly 7.4 acres per year from 1957 to 1978. Although this increased rate could have resulted primarily from the earlier established adult trees acting as seed sources and soil binders, the role of the temporarily altered drainage in the marsh from peat dredging during 1971 cannot be discounted.

The check dams along the dredged channel are diverting water into the natural creek channel and water flow into the lower marsh appeared adequate for cattail growth. Renewed cattail growth was observed at most sites in lower Big Marsh except under canopies of dense older growth. From these observations we concluded that succession has always been occurring in Big Marsh and that while rates may have increased prior to check dam construction, more natural conditions now seem to exist in the marsh.

Big Marsh appears to be an excellent example of small lake or pond ecological succession from open water through marsh, bog, and swamp forest stages. In colonial days Big Marsh was formerly named Great Pond, attesting to the presence of open water. With intensive agriculture occurring in its watershed, sedimentation probably filled the open water areas eventually leading to the swamp forest and thickets observed today. As natural succession continues the red maple swamp-forest should continue to spread into the lower marsh areas replacing most of the cattail marsh except in the northern most area where water levels are deep enough to resist invasion by more terrestrial species.

Management Recommendations

Since large portions of the cattail marsh areas of Big Marsh have developed into the early stages of a shrub swamp, relatively drastic measures such as burning would be required to reverse the successional process. However, this measure would only be temporary and natural succession would continue once again. The burning process would also destroy habitat diversity in the marsh possibly reducing some bird and wildlife species. Big Marsh represents a very classic example of pond/marsh succession and the areas of cattail marsh in transition to a shrub marsh help complete the full natural picture.

The two existing check dams in the dredged channel are adequately diverting water into the natural creek channels. These dams should be periodically checked to ensure protection is maintained.

Use of Big Marsh as a natural field laboratory should be encouraged by the State. Coordination of field trips into the marsh should carried out through the Echo Hill Outdoor School, adjacent to the marsh.

References

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